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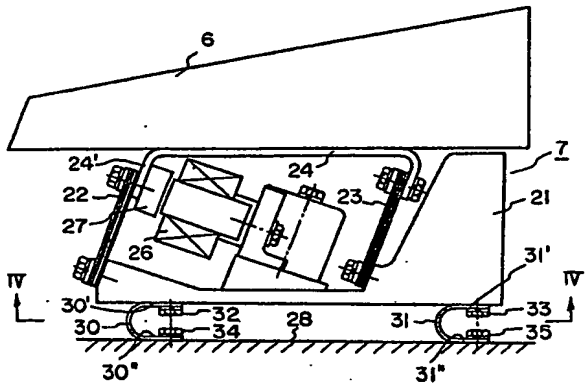
(54) Supply trough support structure.

(57) Disclosed is a support structure for resiliently supporting a supply trough on a stationary portion or foundation, the supply trough (6) being supported on a mounting base (21) by mounting means and set into vibration by operation of a vibrator (26/27) for transporting articles on the trough. The support structure comprises two substantially U-shaped spring plates (30, 31). One leg of each of these spring plates is secured to front and rear portions on the bottom surface of the mounting base (21) and the other legs of the spring plates are secured to the stationary portion (28). Such a support structure for the supply trough can facilitate smooth transmission to the supply trough of vibrations produced by the vibrator, thereby promoting smooth transport of the articles on the supply trough.



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"SUPPLY TROUGH SUPPORT STRUCTURE"

This invention relates to a support structure for a supply trough.

Supply troughs are used in general for transporting articles and, in the case of a computerized combinatorial weighing apparatus, they are used for transporting articles to be weighed to respective weighing hoppers. Such supply trough is so designed and constructed that the trough proper is set into vibration by operation of a vibrator for transporting the articles on the trough proper. For realising smooth transport of the articles on the supply trough, it is desirable to make use of a mechanism by means of which vibration generated by the vibrator may be transmitted smoothly to the trough but not to members other than the trough. With a view to achieving this purpose, the supply trough may be resiliently supported on some stationary portion of the combinatorial weighing apparatus by means of coil springs. However, since the coil springs may be subjected to a bending stress besides elastic elongation and retraction, the vibrating mode of the coil springs tends to change frequently. Hence, transmission of vibration to the supply trough may not take place as desired, resulting in the articles being transported in an undesirably non-smooth manner on the supply trough.

An embodiment of the present invention can provide a support structure for resiliently supporting a supply trough on a foundation or other stationary structure, the supply trough being supported on a support base by mounting means and set into vibration by operation of a vibrator for transporting articles on the trough, wherein the support structure consists advantageously of a pair of substantially U-shaped spring plates, one leg of each of the spring plates is secured to front and rear portions on the bottom surface of the mounting base and the other legs of the spring plates are secured to the foundation or stationary structure, whereby the supply trough is supported on the stationary structure by the medium of the supporting spring plates.

Such an embodiment can be constructed so that transmission of vibration from the vibrator to the trough may be effected reliably so as to realise a desirably smooth transport of articles on the support trough. The design of such a support structure can ensure that it is at least substantially free from undesired lateral bending.

Reference will now be made, by way of example, to the accompanying drawings, in which:

FIGURE 1 is a diagrammatic side elevation showing a computerized combinatorial weighing apparatus which can be adapted to use embodiments of the present invention;

FIGURE 2 is a diagrammatic side elevation showing a supply trough arrangement;

FIGURE 3 is a diagrammatic side elevation showing a conventional mounting for the arrangement of Figure 2;

FIGURE 4 is a diagrammatic side elevation showing a preferred form of apparatus embodying the present invention; and

FIGURE 5 is a sectional view taken along line IV-IV of Figure 4.

Figure 1 shows in side elevation a computerized combinatorial weighing apparatus in which embodiments of the present invention can advantageously be incorporated.

In this computerized combination weighing apparatus, a plurality of weighing hoppers 2 are mounted in a circular array above the circumference of the top opening of a collecting chute 1. Each weighing hopper 2 is operatively associated with a weighing machine 3 designed to weigh articles contained in the weighing hopper 2. A distribution table 4 is supported on an electromagnetically operated vibrator 5 for supply troughs 6 and is set into helical reciprocating rotation. The supply troughs 6 are mounted radially at the outer periphery of the distribution table 4. Sensors 8 are used for optically sensing the quantity of the articles received on the distribution table 4. A pool hopper 9 is provided between each weighing hopper 2 and the corresponding supply trough 6. Each weighing hopper 2 and the corresponding pool hopper 9 are provided with a drive unit 12 and levers 10, 11 adapted for opening and closing the hoppers 2, 9.

The computerized combination weighing apparatus thus constructed operates as follows.

The articles are supplied from the distribution table 4 through supply troughs 6 into pool hoppers 9 and thence into weighing hoppers 2. The articles thus received in the weighing hoppers 2 are weighed by the weighing machines 3 associated therewith. Based on the weights measured by the weighing machines, a control unit, not shown, of the computerized combinatorial weighing apparatus performs a combinatorial weighing operation by comparing the result of each combinatorial adding operation performed on the article weights with a preset target weight and selecting the combination

of articles, known as the best combination, that gives a total weight equal to the target weight or closest to the target weight. In this case, the number of articles in the combination may be arbitrary or predetermined, as desired. The control unit then operates to open the thus selected weighing hoppers 2 by the operation of the levers 10, 11 so that the articles giving said best combination are released into the collecting chute 1 from the weighing hoppers 2 to be discharged towards a packaging machine or bucket conveyor, not shown. This will leave the selected weighing hoppers 2 empty. Articles are then newly delivered from the corresponding pool hoppers into said weighing hoppers, leaving these pool hoppers empty, whereupon a new supply of articles is delivered from the distribution table 4 and the corresponding supply troughs 6. The weighing operation can be continued in this fashion by repeating the foregoing steps.

In the computerized combinatory weighing apparatus described above, the articles supplied from the distribution table 4 are received in the supply troughs 6 and selected ones of the troughs are vibrated by the electromagnetically operated vibrators 7 for transporting the articles from the corresponding supply troughs 6 into the corresponding pool hoppers 9.

Figure 2 shows a supply trough assembly.

In the supply trough assembly, vibration spring plates 22, 23 are mounted in an inclined attitude to the front and rear parts of a mounting base 21, and a channel-shaped trough 6 is mounted on these spring plates by a mounting metallic fitting 24. An intermittently energized induction coil 26 is mounted on the base 21, and a magnetic armature 27 is secured to a bent portion 24' of the fitting 24 so as to be integrated with the spring plate 22 while facing the coil 26. When current

is supplied intermittently to the coil 26, the armature 27 is attracted intermittently towards the coil 26 due to elastic deformation of the driving plate springs 22, 23. Thus the trough 6 is set into vibration with the left-hand side extremity of the trough, when viewed in Figure 2, being pitched downwardly during vibration owing to the arrangement of the springs 22, 23 and fitting 24. As a result of such vibration, the articles placed on the trough 6 may be transported forwardly or from right to left in Figure 2.

In the conventional supply trough mentioned above, the trough is supported resiliently on a stationary portion of the weighing apparatus by means of resilient elements in the hope that the vibration of the spring plates 22, 23 will be transmitted to the trough smoothly while no transmission of vibration to members other than the troughs will normally occur.

Figure 3 shows such support means for the conventional supply trough, wherein like numerals are used to designate the same parts shown in Figure 2. In the support structure, coil springs 29, 29 of a comparatively large spring constant are used for resiliently supporting the mounting base 21 of the supply trough on a stationary portion 28 of the combinatorial weighing apparatus. However, when the trough 6 is supported resiliently by coil springs 29, 29 on the stationary portion 28, since the coil springs 29, 29 may be subjected to a bending stress besides elastic elongation and retraction, there may be frequent changes in the vibratory mode of the coil springs, thereby affecting the transmission of the vibratory force to the trough. The result is that the articles may not be transported along the trough 6 in a sufficiently smooth fashion.

Figure 4 shows supply trough apparatus embodying the present invention, in side elevation, and Figure 5

shows part of that apparatus in underneath plan view corresponding to section line IV-IV in Figure 4. In these drawings, the numerals 30, 31 designate U-shaped support springs having a spring constant substantially equal to that of the aforementioned coil springs 29. The numerals 32, 33, 34, 35 designate bolts for securing the spring plates 30, 31 to the mounting base 21 and the stationary portion of the apparatus.

In this support structure, the supporting spring plates 30, 31 are formed by bending spring steel plates into a U-shaped configuration. The spring constants of the support plate springs 30, 31 are selected to be approximately equal to those of the coil springs 29 mentioned above. First legs 30', 31' of the respective U-shaped springs 30, 31 are respectively secured by bolts 32, 33 to the base 21, while the other legs 30", 31" of the U-shaped springs are respectively secured by bolts 34, 35 to the stationary part 28 of the weighing apparatus. It is to be noted that the bolts 32 through 35 may be replaced by nuts and stud bolts inserted into the base 21 and the stationary part 28 of the weighing apparatus.

In the above support structure for the supply trough, the supporting spring plates 30, 31, used as resilient members or elements for resiliently supporting the supply trough on the stationary part 28, are formed of U-shaped spring steel plates (leaf-springs). Hence, some lateral bending effects that are encountered with the coil springs 29 may be avoided and the vibratory force of the vibration spring plates 22, 23 may be transmitted desirably smoothly to the trough 6, so that the articles can be transported more continuously and uniformly on the supply trough 6.

While the foregoing description has been made with

reference to U-shaped support spring plates 30, 31, these spring plates need not be precisely U-shaped but may be in any desired form resembling the U-shaped configuration effectively.

As described above, the supply trough is supported by vibration spring plates mounted in the inclined position on the mounting base, and may be set into vibration by operation of a vibrator, whereby the articles may be transported on the supply trough. The trough is supported on some stationary portion of the automatic combination weighing apparatus or the like by the medium of resilient elements in the form of substantially U-shaped support spring plates. Respective first legs of these U-shaped spring plates are secured to forward and rearward portions of the bottom surface of the supply trough base, and the other legs of the spring plates are secured to the stationary part of the automatic combination weighing apparatus or the like. The supply trough thus supported on the support structure can operate in a near optimum vibrating condition.

Since various changes can be made within the scope of the invention, it is obvious that the present invention is not limited to the details as set forth and may cover many changes as may come within the scope of the following claims.

Claims:

1. A support structure for resiliently supporting a supply trough on a stationary portion, said supply trough being supported on a mounting base by mounting means and set into vibration by operation of a vibrator for transporting articles on said trough, wherein said support structure comprises at least one pair of substantially U-shaped supporting spring plates, one leg of each of said spring plates being secured to a front or rear portion of a lower surface of said mounting base and the other legs of said spring plates being secured to said stationary portion, whereby the supply trough is supported on said stationary portion by means of said U-shaped supporting spring plates.

2. A support structure as claimed in claim 1, wherein said U-shaped supporting spring plates are secured to said mounting base and said stationary portion with bolts.

3. A support structure as claimed in claim 1 or 2, wherein said mounting means comprises a mounting metallic fitting for supporting said trough and spring plates secured to both said metallic fitting and said base.

4. A support structure as claimed in claim 3, wherein said vibrator is mounted for setting said mounting metallic fitting into vibration.

5. A support structure as claimed in claim 4, wherein said vibrator is mounted on the mounting base.

6. A support structure as claimed in claim 3, 4 or 5, wherein said mounting metallic fitting has bent portions on both end parts, said bent portions being secured to said spring plates.

7. A support structure as claimed in claim 1, wherein said spring plates are mounted parallel to each other.

8. Vibratory conveyor apparatus, comprising a supply trough (6), a base member (21) on which the trough is mounted so as to be capable of longitudinal vibratory movement with respect thereto, vibrator means (26/27) operable to bring about such movement of the trough so as to cause articles thereon to move in a feeding direction therealong when the apparatus is in use, and a stationary support structure (28) on which the said base member is resiliently mounted, characterised in that the base member (21) is mounted on the support structure (28) by means of two leaf-springs (30,31) which are spaced apart substantially longitudinally of the said trough (6), each leaf-spring having first and second limbs extending substantially longitudinally of the trough (6) from an intermediate portion of the leaf-spring, the respective first limbs (30',31') of the leaf-springs being secured to the said base member (21), and the respective second limbs (30", 31") being secured to the said support structure (28).

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Fig. 1

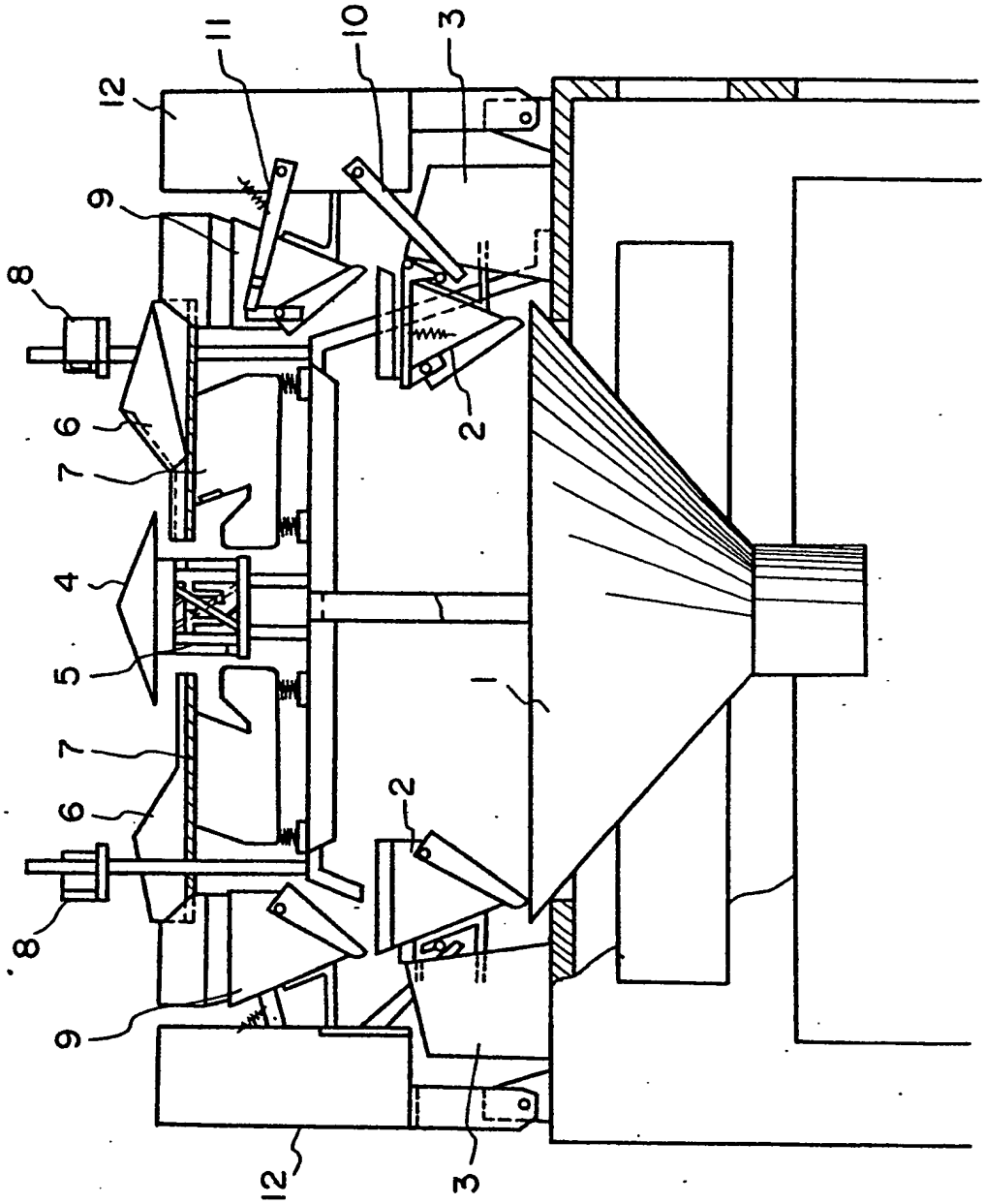

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Fig. 2

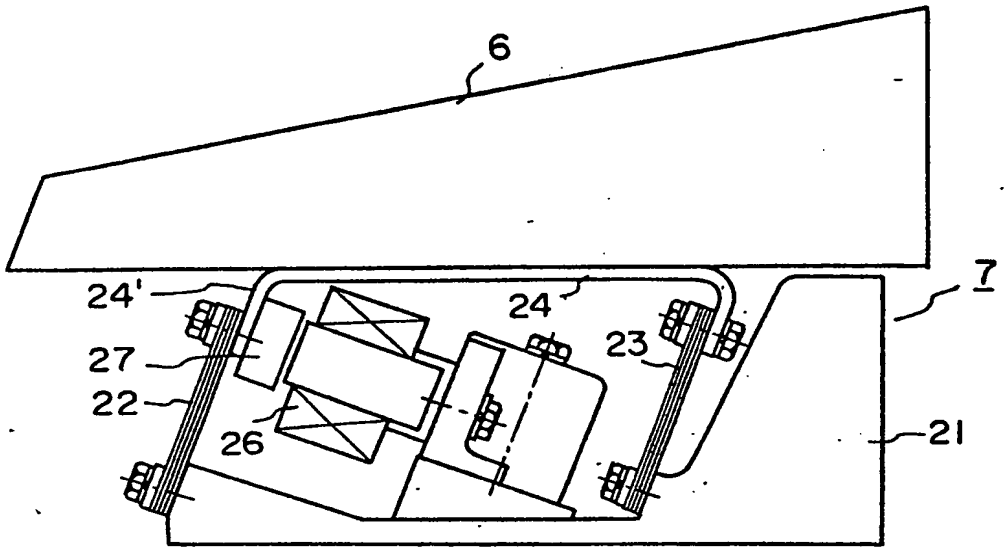

Fig. 3

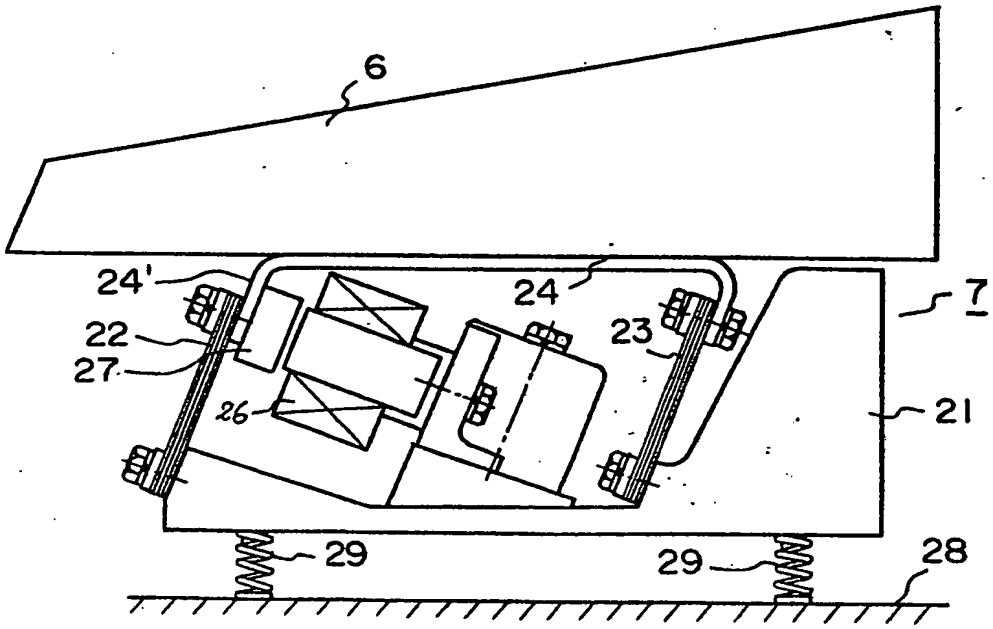

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Fig. 4

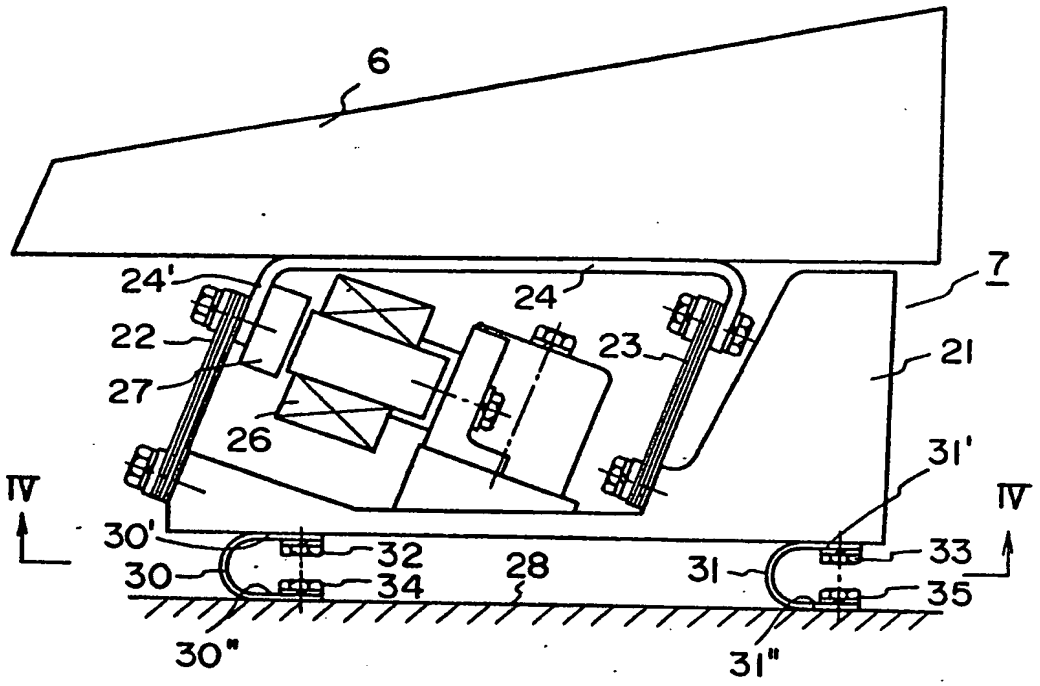

Fig. 5